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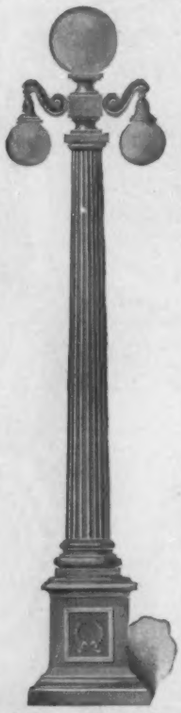

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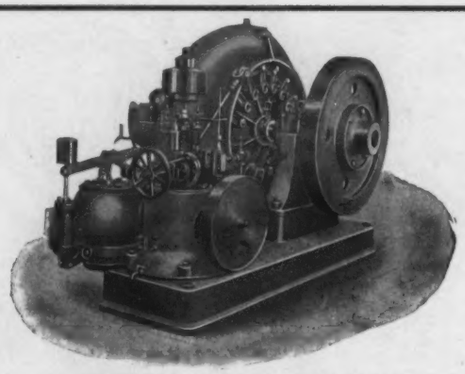

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BY THE INSPECTOR

"When I go out on inspection, or to 'shoot trouble' and sometimes have to listen to subscribers' tales of poor service, I see a side of the telephone business that the officials never think of when they are buying telephones or getting bids on a switchboard, or figuring on supplies.

"The operating company official who prides himself because he forced a low price on a switchboard order from some telephone manufacturer, who in the stress of six or seven companies' competing bids out his figure to the last dot—this official seldom meets directly the complaints of the people who have to use the telephones and the service of a cheaply built board. He never realizes the repair bills that follow, swiftly and surely, for telephones and switchboards sold at cut rates make a 'cut-rate' exchange. Somebody must stand for the 'bargain price', and in the long run, it's the buyer. A switchboard cheaply sold is cheaply built—Doesn't that stand to reason?

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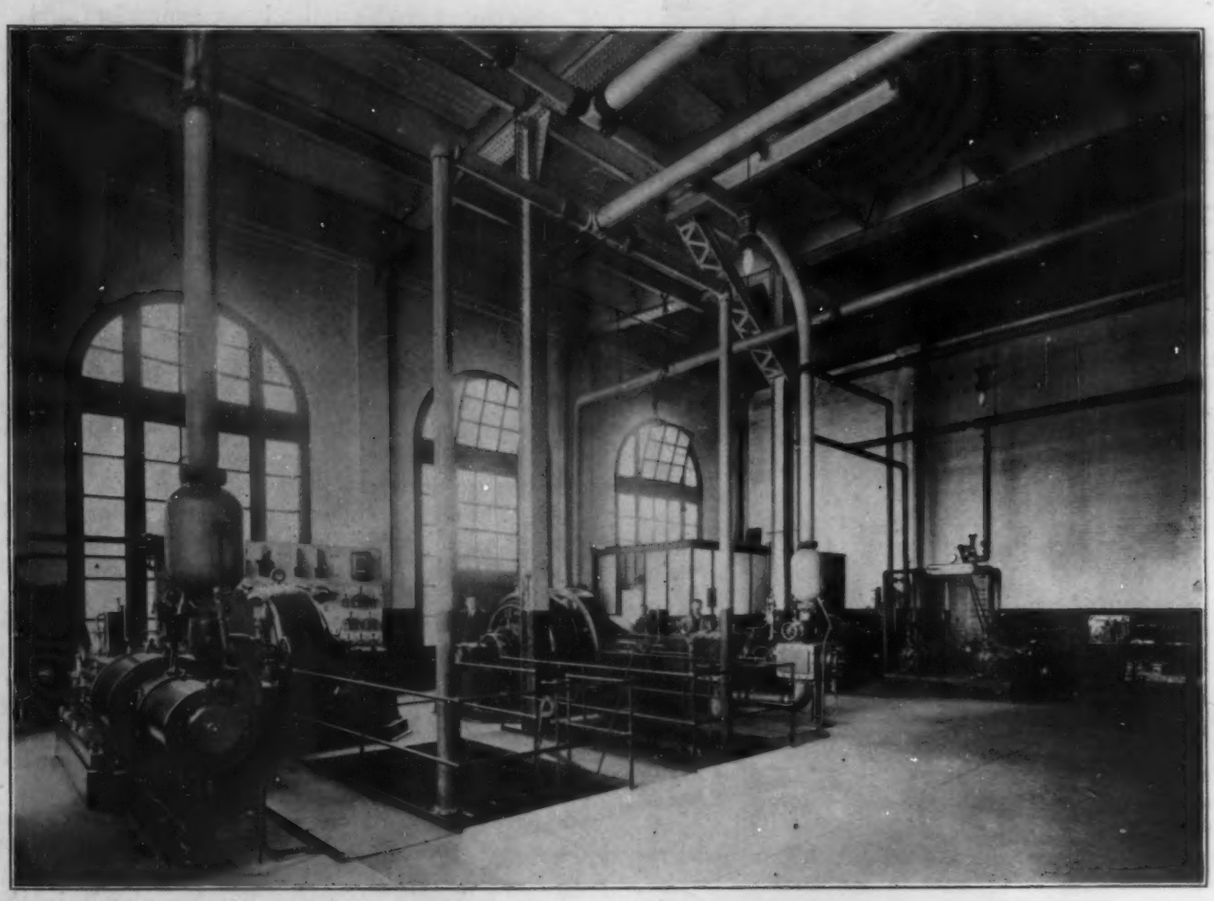
ELECTRICITY IN A MODERN STEAM LAUNDRY

There are but few labors to which electric power can be better applied than those of the laundry. As an example attention is here to be directed to the equipment of the Metropolitan Laundry at Eighth and Harrison streets, San Francisco, which is said to be the largest and most up-to-date in the United States. This installation consists essentially of two parts, the power plant and the laundry proper. Taken together they occupy nearly an acre of ground, and are substantially housed in two brick buildings separated by an alley, under which a tunnel carries the electric conduits, and steam and water pipes, both hot and cold water.

The most noteworthy feature of the plant is its independence from all outside sources of power and water. There is nothing more essential to a laundry than water. This is obtained in abundance from five wells which have been sunk to a depth of 200 feet. Three of these wells are equipped with air-lift and two, with steam pumps, one of the latter being a double acting pump, especially designed and patented by the chief engineer of the plant, Mr. J. G. Dorward.



Power Plant of Metropolitan Laundry, San Francisco.

These pumps deliver the water to a sump from which a motor-driven centrifugal pump elevates it 65 ft. to the top of the water softener.

This is of the Kennicott type with an hourly capacity of 30,000 gallons. The water from the wells is hard, that is it contains about 25 grains of carbonate of magnesia to the gallon. This is precipitated by adding a solution of soda ash and lime as the water enters the top of the softener. This solution is steam-siphoned from a lower mixing vat to a receiver from which it is automatically supplied in any desired proportion to the entering hard water. An ingenious electric contact and solenoid-operated counter in the chief engineer's office gives convenient record of its operation.

Boilers of Metropolitan Laundry.

This Kennicott softener is the largest on the Pacific Coast, holding 125,000 gallons of water, being 18 ft. in diameter and 65 ft. high. By its means 90 per cent of the hardness of the water is removed, which makes a great saving in the wear and tear on the clothes, and also in the soap bill. The softener also supplies water to the boilers, although the chief reason for their remarkable freedom from scale is attributed to the fact that the plant is run condensing. The cooling water from the condensers flows to a tank which supplies the laundry, its heat being further maintained by the exhaust from the air compressor.

The hardening ingredients in water destroy the effect of large quantities of soap by uniting with it and forming an insoluble compound known as "soap curd." Each degree of hardness per gallon of water destroys approximately 1½ pounds of soap per 1000 gallons of water before any detergent action is produced. In other words, the hard water is softened by the use of soap before any beneficial action is obtained from the soap. To overcome this wasteful result laundry men are forced to add sodas to the water, which precipitate the hardening ingredients upon the goods, making them very harsh. These sodas also rapidly destroy the fibre. The soap curds, deposited in the fibre of the goods, being insoluble cannot be removed by subsequent rinsing. These curds cause white goods to become a dirty gray and are decomposed by the hot iron, causing greasy appearing, yellow stains or streaks most frequently noticed at the seams. The harshness, due to these curds and the hardening ingredients precipitated by the washing sodas, is especially noticed in woolen and flannel goods.

The steam plant supplies power for pumping 175,000 gallons daily, and also furnishes electric current for heating, light and power in the laundry. The boiler equipment consists of three Heine safety water-tube boilers made by the Risdon Iron and Locomotive Works, of San Francisco, each of 277 rated horsepower. There is also a low pressure Risdon boiler used as a water heater. The boilers are oil fired and equipped with McLain oil burners, the duplex oil set being a 4½ x 2¾ x 4 in. Worthington.

The generating plant includes four Westinghouse direct current dynamos arranged for three-wire service. The two main generators are 150 k. w. 220 volt machines direct connected to tandem compound Ball engines, 11 x 19 x 20. The hot-well, feed-water pumps and condensers are placed in a pit between the two engines. All condensation from the laundry is returned to the power plant and by this means fully 75 per cent of the water is saved. In addition, there are two 17½ k. w. d. c. Westinghouse generators driven by Ohmen engines, which are used to even up the unbalanced load on the large generators and to supply current for lighting and operating the different departments when necessary to run overtime.

By means of the three wire system, current for lighting is supplied at 110 volts and for power at 220 volts. The Westinghouse three-wire system, as here installed, is so arranged that the current is supplied by one machine, so in the event of light load it is not necessary to run the two generators. The generators differ from the standard single voltage, direct-current machines by the addition of auto transformers and an arrangement of the armature lead connections somewhat like those on the alternating current side of the armatures of rotary converters, the armature lead of three-wire dynamos being connected to collector rings placed on the shaft. The connections from the armature to the collector rings are two-phase, across which a pair of auto-transformers or balancing coils are connected. These balancing coils consist of a single winding upon a laminated iron core. The assembled coils are placed in iron cases filled with oil. The middle points of the balancing coils are inter-connected and from this connection the neutral lead of the three-wire system is led. It is obvious that the pressure between the neutral wire and either generator terminal is one-half of the 220-volt generator pressure. In this installation the coils have been placed in the wall, close to the switchboard, which arrangement has proved eminently satisfactory.

The switchboard consists of four panels,, one for the two 150 k. w. generators; one for the two 17½ k. w. machines; one for the motors in the power plant, and one for the power and lighting circuit in the laundry.

As already mentioned, a 30-in. centrifugal pump, single stage, built by the Risdon Iron Works, is driven by a 20 h. p. motor to pump water from the sump to the top of the softener. There is also a steam driven air compressor installed by the Compressed Air Machinery Company, of San Francisco, supplying air for

the air-lift pumps and to various machines in the laundry.

The lighting circuit supplies current not only for the incandescent and arc lamps with which the plant

Motor-Driven Washing Machines.

is equipped, but also for the electric irons. These are the standard irons manufactured by the Pacific Electric Heating Company of Ontario, California, and take from 6 to 10 amperes at 110 volts. As there are 50 of these hand irons the large amount of current required is readily appreciated. But considering the

Motor-Driven Extractors.

great amount of time that they save and the excellence of the work they do, the cost is well justified.

The power circuits furnish current for electric drive of all the machines in the laundry, including washers, extractors, mangles and ventilating fans. These motors aggregate sixty-two in number and vary in size from ¼ to 20 h. p. They are all made by the General Electric Company and where not direct connected, are equipped with the Morse silent chain.

Motor-Driven Flat Work Ironers.

Upon delivery from the wagon, all pieces are first marked for identification, either by hand or more recently by a motor driven marking machine, manufactured by the National Marking Machine Company. This machine resembles a linotype without the matrix-casting mechanism. The pieces are then segregated as to kind, for each class, such as blankets, flannels, toweling and starched pieces, requires different treatment. All plain pieces are first placed in washing drying and are dried and smoothed in the flat work irons. Collars, shirts and other starched pieces are washed in machine and dried in steam-heated drying rooms, being ironed by hand.

There are 110 washers arranged in ten clusters of

Electric Hand Irons.

eleven each. Each cluster is driven by a 15 h. p. motor. Hot and cold water is supplied from the power plant and soap is made on the premises.

The extractors, or wringers, are 40 in number, being arranged in ten lines of four each. Each set of four 28-in. extractors are driven by 7½ h. p. motors

from overhead line shafting. These are used for drying the heavy and the coarse pieces.

There are eight Hagen mangles, two being four-roll and the others six-roll machines. Each is operated by a three h. p. variable speed General Electric motor with rheostat control.

There are five conveyor dryer houses, each operated by a ¾ h. p. motor. These are heated by steam coils and during the course of one-half hour's travel through them, the finer pieces are completely dried. There are also three lines of shirt machines, each driven by 5 h. p. motors. All the dryer houses are supplied with steam at 120 lbs. pressure, the power plant being operated under 160 lbs. pressure. The steam line to the laundry is set with a 4-inch safety valve connected to the 6-in. line, so as to protect the laundry machinery, in case high pressure steam is accidentally introduced when the boilers are changed. The flat work irons are all steam heated. This condensation, as before mentioned, is from the steam traps returned to the power plant. In the collar department, the collar tables, ironers and dampeners are all operated by individual motors, connected to the machine by Morse chains. In the shirt department there are 18 body ironers, gas heated, one 3 h. p. motor operating six machines. This plant is under the management of F. F. Connor.

AIR-NITRATES IN GERMANY.

Consul-General A. M. Thackara of Berlin answers as follows the queries of an American correspondent regarding the manufacture of air-nitrates and the status of farming in Germany: Atmospheric nitrogen is utilized in making nitrates for fertilizing purposes, in accordance with two general systems in Germany, as well as in Norway, Italy, and other European countries, and in Canada. (1) The formation of the so-called calcareous nitrogen (kalckstickstoff), which has the chemical formula Ca(CN)N, and which is formed by passing nitrogen over heated calcium carbide or through a heated mixture of lime and charcoal, and (2) the direct combination of the elements in the air—oxygen and nitrogen—by the use of the electric spark and the formation of nitrate by bringing these combinations into contact with the proper calcium or other components.

There are several processes by means of which the nitrogen, which combines with the calcium carbide in the formation of calcareous nitrogen, is separated from the oxygen of the air. One is by passing air over the copper coils by means of which the oxygen is removed. Another process is to obtain free nitrogen by the partial evaporation of liquefied air. The great expense attending this latter process renders it impracticable, and the nitrogen so obtained is still much mixed with oxygen compounds. Nitrogen is also obtained by one German firm in Hamburg and Hanover by cooling the gases of combustion and removing the impurities by passing the gases through retorts filled with copper and copper oxides and then through some substance that absorbs the carbon dioxide.

The so-called calcareous nitrogen obtained by the various processes is a grayish substance containing about 20 per cent nitrogen. As a fertilizer it is generally supposed to be as efficient as ammonium sulphate and but little inferior to saltpeter. The exact effect of the cyanide in the compound is as yet not understood. By heating, the whole of the nitrogen in the compound is changed into ammonia, from which ammonium sulphate may be formed. The practicability of the production of calcareous nitrogen depends upon cheap power supply, and hence the plants are generally located where water power is available. The substance is produced in many different countries and the estimated total production for 1908 was about 45,000 tons.

The second system by which nitrates are obtained by the direct combination of the oxygen and nitrogen of the air is much more recent in its development than the above. After numerous attempts had been made in various countries, the Norwegian inventors, Birkeland and Eyde, finally succeeded in making the process industrially practicable. According to their system, the end of each of the electric poles through which a current is passing is exposed to the action of a magnet which causes the electric spark to spread out into a disk-like flame. This flame is surrounded by some material that resists combustion, thus leaving a disk-shaped inclosure through which the air is drawn. As the temperature at which this reaction takes place is very high and as the atmosphere passes comparatively rapidly through the flame, only from 1 to 2 per cent of the elements in the air is transformed. The compounds formed begin to decompose when their temperature is lowered, and therefore methods are devised to rapidly decrease their temperature to the point at which they can form more stable products. For this purpose the compounds are passed through an evaporating apparatus, and after their temperature has been reduced to about 50 degrees Reaumur they are passed into an oxidation chamber and oxidized into nitrogen dioxide, from which the nitrates are made. The greatest advance in this system has been made in Norway, principally by the firm of Birkeland & Eyde, and in factories located at Notodden, Svalgfos and Christiansand. A similar system in Germany is used at the "Badische Anilin und Soda Fabrik" at Ludwigshafen am Rhein. The nitrates so formed are quite pure and have thus far been consumed principally in the industries, only a small quantity having been used as fertilizers.

The cost and the volume of production of each system depend upon the availability of cheap power, and the production of calcareous nitrogen also depends upon the prices at which lime and coal or charcoal are available. One estimate places the cost of the production of calcareous nitrogen containing 20 per cent nitrogen at 270 to 315 francs ($52.11 to $60.79) per metric ton (2,204.6 pounds). This would make the nitrogen in the compound cost 26 to 30 cents a kilo (2.2 pounds), while the cost of the nitrogen in compounds formed by the direct combination of the elements in the air is generally conceded to be less. The experiments made with fertilizers of either system, in comparison with Chilean saltpeter, are generally favorable to the artificial product. In sandy soil the calcium nitrate formed by the direct combination of the elements in the air brought even better results than the Chilean saltpeter.

GOING VALUE AS AN ELEMENT IN THE APPRAISAL OF PUBLIC UTILITY PROPERTIES.[1]

BY WM. H. BRYAN.

Appraisals of public utility plants are made for a variety of purposes—sale, bond issues, taxation—and more often in recent years as a basis for rate-making, a function which is coming more and more to be exercised by the State or municipal authorities.

Such appraisals must cover both the tangible and the intangible values. The former present no great difficulty, being usually taken as the present cost of duplicating the property used and useful for the convenience of the public, less depreciation. The intangible values are usually two in number, "franchise" and "going" value.

Where the utility is operating under an existing franchise, future net earnings during the unexpired period are estimated. These, when reduced to present worth, fairly represent franchise value. Where the franchise has expired, or where the municipality has the right to purchase at stipulated periods, there is, of course, no franchise value.

Going value, however, may continue even after the franchise has expired so long as the plant continues to serve the community. This value was first officially recognized in Judge Brewer's decision of the Kansas City Water Works case (see United States Federal Reports, 62—853) in the following language: "The city steps into possession of a property which not only has the ability to earn, but is, in fact, earning. It should pay, therefore, not merely the value of a system which might be made to earn, but that of a system which does earn."

It is an unfortunate fact, however, that agreement is still far from general among engineers both as to the exact definition of going value and the proper method of determining its value. This is well illustrated in a recent compilation of twenty valuations, in which it varies all the way from 0 to 47 per cent of the physical value of the plant. Even wider ranges would probably be found if all the appraisals in which it has been considered by able engineers of varying view-points could be compiled and compared. In one of the most important appraisals of recent years, in the hands of five of the leading specialists of the country, no two of them agreed as to the method of computation.

There is, however, much evidence indicating that substantial progress is being made towards clearer and fairer views. The author ventures to indulge the hope that it may soon be possible to so handle this matter that the justice and fairness of our methods will be so apparent as to appeal, not only to specialists, but to judges and juries and to mayors and boards of aldermen as well. There must surely be a way to so determine going value as to satisfy both seller and purchaser.

Perhaps the clearest official utterances thus far made on this subject are the recent decisions of the State Railway Commission of Wisconsin. In the Cashton Light & Power Company case they said:

"The element of "going value" created by the investments made in developing the business and in addition to the cost of the physical structure must be taken into consideration in fixing value; although the franchise of a public utility operating under an indeterminate permit has expired upon the exercise by the municipality of its option to purchase, the plant is to be taken over as a going concern, and just compensation must be awarded for the property taken as a living and operating entity, engaged in serving the public, and not as a mere plant without patrons and without privilege or right to operate and to serve the public and having but a salvage value."

Also in the Antigo water and the Marinette telephone cases:

"The theory of the Wisconsin public utilities law is that rates shall be reasonable and shall be not greater than enough to yield a fair return on the investment. In determining the investment as a preliminary process to the fixing of rates, the Commission had to deal with the claims of large "intangible" franchise values as well as "going values," in both the Antigo water case and the Marinette telephone case. Regarding the former, the Commission holds that if the municipality required the payment of money or its equivalent, or there was necessary legitimate payment made for the franchise, then the sum which may reasonably be said to have been paid for the franchise may be included in the valuation, the same as money necessarily invested in the physical property. But the Commission refuses to consider the claims of some experts and corporations that franchises for which no money was paid may have "intangible" values which should be considered in the making of rates.

It has been held by experts that "going value" should be allowed as so much per customer, or as a percentage of the receipts, and some have considered it as of as great, if not greater, importance than the physical value of the plant. The Commission holds that the actual reasonably wise expenditure of money towards getting the business of the plant established may be included in the value to be allowed for the purpose of fixing rates. Since no plant pays at the outset, and the first years of operation are almost invariably accompanied by losses or necessary deficits, the Commission holds that such losses may be said to represent the cost of securing an established or going business, and as such may be included in the value or investment upon which the rates for public service shall be fixed. But the converse of the rule also holds; that is, if a plant has in the past earned more than a reasonable return, possibly through the toleration of excessive rates, the excess over reasonable earnings may, under certain conditions, be subtracted in determining the present value of the plant. That is, a "going value" may be negative. In the case of the Marinette Telephone Co., for example, the Commission found upon its investigation of the financial history of the company, that through a period of recent years the company had been enjoying a sufficiently high rate of return to write off the early deficits in so far as such deficits might be allowed as going value.

It may be noted in passing that the now generally accepted view is that the plant value upon which a

[1]Read before the Engineers' Club of St. Louis, October 20, 1909, and printed in the October, 1909, "Journal of the Association of Engineering Societies."

fair return must be earned is the present cost of duplicating the existing plant (less depreciation) and not its actual original cost. It is not material, therefore, what the original outlay for franchise may have been, but it is important to know what moneys, if any, would now have to be expended to secure such a franchise. Neither are past losses or profits conclusive further than as they throw light upon probable future earnings.

The important facts in the above rulings are that the Wisconsin Commission has officially recognized the propriety of including going value in appraisals and has pointed out that it should be computed as the sum of two outlays:

First, moneys spent directly for getting business; and

Second, moneys advanced to cover losses in the earlier years of operation.

These amounts, of course, are not the sums which the plant under consideration may actually have expended, but the amounts a plant starting today would probably have to pay to secure sufficient business to make the plant self-supporting.

Having ascertained the present value of the physical plant, the Commission considers it proper to add to it these two amounts, the total being the fair value at which the plant might be sold, or upon which the owners are entitled to earn a fair return.

Assuming the existence of the bare physical plant, without connections or business, what additional outlay would be necessary, under the conditions existing at the time of the appraisal, to bring its income up to a point where its losses would cease and it would begin to earn a fair return?

Legitimate expenditures to build up business would cover such items as advertising circulars, solicitors, special rates or even free service for limited periods, free connections, plumbing at or below cost, etc. Not infrequently solicitors are paid a fixed sum per contract brought in. Such outlays would unquestionably hasten the attachment of services and thus shorten the unproductive period. For a water works it would be proper to take into consideration the present-day general knowledge and appreciation of the advantages of water under pressure, and the fact that it is now a necessity in manufacturing, commercial and domestic life. In any modern city the demand would be immediate and extensive, and the rapidity of securing business would in most cases be limited only by the ability of the working forces to install the plumbing and make the connections. At starting, the plant would have tht public revenue from fire hydrants, public buildings, fountains, etc., and soon thereafter the income from a considerable number of private consumers. This would cover a large part of the operating expense, probably half or more It then remains for the appraiser to estimate the period within which the necessary volume of business would be connected and to compute the probable losses up to that time. This is a matter calling for the trained judgment of a skilled observer. It depends upon the size of the city, the character and habits of the people, their wealth, the number of factories, breweries, railroads, etc., and the quality and quantity of other available supplies, such as wells and cisterns, and many other things.

The physical value of the existing plant is ascertained by estimating the cost of a duplicate plant and deducting depreciation, such cost including, of course, interest, administration, etc., during the construction period. Some engineers hold that as this duplicate plant could not be gotten into actual service for a considerable period, the net earnings of the existing plant during that period are properly a part of going value. The income of the existing plant being limited, however, to a "fair return," there would be no excess earnings, and, therefore, nothing to add. From this standpoint the city's right to purchase in no way affects going value.

The probable operating expense of the "starting plant" may be projected into the future with reasonable accuracy. It must, of course, include not only the ordinary expenditures for labor, fuel, supplies, etc., but also taxes, repairs, administration, interest and depreciation. The growth of income, however, is not so easily estimated, as it involves both the volume of business and the rates charged.

Income depends upon rates. A favorable schedule, not necessarily the highest, will shorten the unproductive period and thus decrease going value. Unwise rates retard growth and increase going value. Attempts to determine going value must, therefore, pre-suppose some basis of rates. But rate revision, directly or indirectly, is the purpose of most appraisals. To assume rates as a step towards fixing rates is to reason in a circle. What, then, shall be done?

Many appraisers assume that existing rates continue. It is argued that they furnish the only definite data available affecting income. To change them would be to enter upon the problematical. But existing rates may be either too high or too low for a fair return.

The tentative or "cut and try" method would seem much preferable. First compute income and then going value, using existing rates. If that income is more than a fair return, repeat the calculation at a lower rate. If insufficient, try a higher schedule. Continue these trials until a rate is found which will insure a fair return within a reasonable period. The going value on this schedule would seem to be the proper one.

Going value thus determined is clearly independent of whether the franchise has expired or whether the city has the right to purchase. It enters into the appraised value of the plant, just the same as any physical item, at its cost of reproduction.

It is interesting at this point to note the Wisconsin Commission's conclusion that going value may be negative, when later profits above a fair return have more than wiped out the deficits of the earlier years. Is not this a reasonable consideration for the future? Assuming a rate schedule and growth of business which would make the plant self-sustaining within a reasonable period, the normal continuation of that growth would cause the plant to earn profits which would soon offset the earlier losses and thus destroy our measure of going value. It would be within the legitimate power of the authorities to so adjust rates as to bring this about.

The author of the paper above referred to defines

the going value of an existing plant as the cost of reproducing the income of that plant. He fixes its amount by computing the difference between the net results of its operation and the net results of a well-conducted "starting plant, through the time necessary to enable the starting plant to be completed and recover an income equal to that of the going plant."

The differences between these views and those now officially promulgated by the Wisconsin Commission, which, by the way, are held by many able engineers, are worthy of serious consideration.

The first difference is one of definition, Mr. Alvord holding that the income, the cost of producing which is to be estimated, is the gross income of the existing plant. The Commission's views is that an income sufficient to meet operating expenses is sufficient. Lossess having ceased, further business is secured without cost. Previous losses may properly be called going value and charged to capital account. A greater income is of no interest or value to the municipality, for rates will at once be readjusted to the "fair return" basis, whether the appraisal is for sale or for rate fixing. No city could fairly be asked to pay an inflated "going value" based on an excessive income which it will immediately proceed to reduce. Existing income based on existing rates is, therefore, valueless for this purpose, and may even be misleading, as producing sometimes more, sometimes less, than a fair return.

Viewed from this standpoint, the financial history of the existing plant has only an indirect interest. It may help us to estimate the cost of operation and to form some judgment as to the time within which the starting plant will begin to earn a fair return.

The second difference between Mr. Alvord and the Commission lies in the method of computation. Nowhere does he recognize the direct expenditures for getting business already referred to. He compares the existing plant already doing business as a going concern with a similar "conceptual" plant without business, which would have to be built and put into operation. Meanwhile the business of the existing plant continues its normal growth. He concedes, however, that at some future date the starting plant will acquire an income equal to that to which the existing plant has then grown. The difference in net operating results up to this date comprise, in his opinion, the full measure of going value.

Two perplexities here confront us. The existing plant, with its prestige of years, its standing in the community, its "going value," if you please, would seem to have a permanent advantage. Having usually twenty or more years the start, ought not its continuing growth to keep it permanently ahead of the newer plant? And if there is to be forever a difference in their income, then the going value thus computed must be infinite.

If, however, the "starting plant" is assumed to grow at so rapid a rate that in a few years its income equals that of the existing plant, why should that rate of growth then suddenly drop to that of the existing plant? Will not the same conditions which have caused its previous rapid growth continue? If they do, thenceforward there would be an excess of income which would soon wipe out the earlier shortages, as has been well pointed out by the Wisconsin Commission.

A system of computing value whose results may range all the way from zero to infinity is not pleasant to contemplate. But these difficulties vanish when the "fair return" income, and not the existing income, is taken as the basis.

The above method might fairly measure the increased worth of the existing system to a private purchaser as compared with a prospective plant without business, assuming a continuance of rates and income. But such assumption cannot be made in the case of municipalities (except where unexpired franchises exist), as the ultimate purpose of practically all investigations of this kind is rate revision. Furthermore, the cost of reproduction is the ruling condition, not the value of the thing reproduced, exactly as is the case with a pumping engine or any other feature of the physical plant.

Many attempts have been made to compute going value along similar lines, although but few have followed the exact definitions given. In some such comparisons interest and depreciation during the construction period have been assumed equal on the existing and starting plants, while they should not be charged against the starting plant at all. There is no depreciation prior to the start, and interest is always included in the construction account.

This, however, brings up another matter. As has been well said, it is not fair to substitute hindsight for foresight. No designer can foresee all possible contingencies; no engineer is infallible. Mistakes have always been made, and always will be. Boilers, engines, standpipes, buildings, reservoirs, purification systems, even sources of supply, have failed, necessitating removal and, in some cases, abandonment of entire plants. Sometimes the city has not grown in the direction originally expected. Even the most capable and experienced designers, associated with men of the soundest business judgment, have encountered such disasters. It is a hazard of the business. If a new plant were begun tomorrow either by private parties or the municipality, this risk, in greater or lesser degree, would necessarily inhere in it.

No fair-minded appraiser, however, would include allowance for such mistakes, however unavoidable. The city cannot fairly be asked to purchase at or pay rates on values so determined. But does not the fact that the existing plant has, as it were, "sown its wild oats," has discarded its unwise and useless equipment and has demonstrated the fitness of its remaining parts, make it of more value than a new plant with that unavoidable experience still to go through?

The author confesses to some uncertainty as to just where this factor should appear, but that it is an element which should not be overlooked he is certain. For lack of a better place he suggests that it have its weight as one of the "contingencies" in fixing the percentage to be added to the cost of reproduction. In the average case, however, its value would not be large.

What should be the attitude of the conscientious appraiser towards those plants which are losing money? Has such a plant a going value? This question has been answered in all seriousness in the

affirmative. It has been held that an established plant would lose less money than one with its business still being developed. Under Mr. Alvord's method the excess in loss of the "starting" over the existing plant would measure the going value. The Wisconsin Commission plan could not, of course, be applied, as the continuing losses would make the going value unlimited. Under these circumstances there may be several views:

1. A study of the situation may show that the normal growth of the business will soon end the losses.

2. The losses may be decreased, and in due time ended, by some reasonable advance in rates. In both of these cases the Wisconsin rule could safely be applied.

3. If, however, the situation is such that there appears to be no reasonable way to make the plant earn a fair return, the solution becomes complex.

Such cases, unfortunately, are not uncommon, particularly in smaller cities and in undeveloped or boom territory. Sometimes both the city and the owners have been over-sanguine as to the future. Many cities have in times of enthusiasm and prosperity been induced by energetic promoters to enter into contracts for service which have later proved exceedingly unwise for all parties concerned. Business has not developed, nor has the place grown as anticipated. Important industries may have ceased; opposition towns or railroads may have taken the business away.

While the plant is losing money at the existing rates, it is nearly always true that these rates, both public and private, are a serious strain on the limited resources of the city and its people. No advance is, therefore, possible; it may even be impossible to maintain existing rates. Not infrequently the expiration of the contract is looked forward to as a date when relief may be expected.

Such contracts are usually for periods of twenty to thirty years. Usually all obligations between the parties end with the expiration of the contract. There seems no escape from the conclusion that the owners of the plant must accept the situation as it then exists. As they would have been entitled to the profits of a successful plant, so also must they accept the losses of the unprofitable one. If the cost of service is beyond its means, the city is at liberty to discontinue it. If the contract made no provision for extensions, or if such provisions were illegal, the plant has no rights superior to those of the municipality. It is to be presumed that the owners knowingly took the risk of securing, within the contract period, such returns as were necessary.

This view is, of course, hard on the invested capital, but the law very wisely prohibits municipalities from incurring obligations which may prove onerous to future generations. Posterity should not be made to suffer through the errors of earlier days. In some cases it has been held that, owing to the uncertainties attending the situation at the end of the contract, the "fair return" basis entitled the owners to rates which would make the earnings sufficient to retire the entire investment, less scrap value, within the contract period. This interpretation, however, is very rare. It has a counterpart in those states which require the establishment of sinking funds by municipally owned plants to retire the bond issue within a definite period, usually much less than the life of the plant.

The problem then is, not whether a going value should be included in the value of the plant, but to determine a value which the maximum income possible under the existing circumstances will support. In other words, the actual worth of the service to the community fixes a limit to the value of the plant, beyond which no figures, however elaborate or logical, can go.

Under a strict interpretation of either the Alvord or the Wisconsin theory, the city would be required to purchase the plant at a valuation, or pay rates giving a fair return on a valuation based on cost of duplication less depreciation plus going value. The latter, on account of the slow building up of the business, would be large.

Clearly, however, this would be unfair to the city, as involving prohibitory rates, rates which the public service could not stand, and which would discourage private consumption and prohibit growth, thus minimizing private revenue. The difference could not be made up by increased taxation, as this is limited by law.

We may of course, take the broad stand that if a city wants water works it must pay the price; they cannot be run as charitable institutions. But there is a limit to the city's ability to pay. Is it not true, therefore, that the plant, in order to continue to serve the community, must be willing to adjust its rates to a basis which the people can pay? Would not any other course necessarily end in forcing the city to discontinue a service beyond its means, a result disastrous to all concerned?

Evidently the construction of a plant at all in such a location was a mistake on both sides. Is it not the clear duty of the appraiser in such cases to eliminate, on the one hand, every possible element of questionable value and to get his figures down to bed rock. in the hope of finding a way to meet the exigencies of the situation, and, on the other hand, to see that the city acts in equal good faith, that it properly appreciates the full value of a good supply and apportions the maximum amount possible to that service? It is worth remembering that in many cases the lowering of private rates to points originally considered suicidal has so attracted consumers as to materially increase both gross and net income.

Evidently in such unfortunate cases the situation demands a valuation quite apart from the actual physical plus the going values, however just those values may in the abstract. Fairness to the municipality is not less essential than fairness to the plant. The courts have decided that while such regulations are intended to be mutually fair, they must in any event be fair to the city.

Clearly such reasoning is only effective when the city is prepared for the alternative of abandoning the service. If it is so situated that it cannot do without the service, then it must find a way to pay a fair return for it. But in no event can the value of such

a service exceed the cost of getting that service in some other way.

Further perplexities are often found. It has been questioned by many fair-minded men whether the plant, after all, has any ownership of the business on which going value is based. Should the people pay for what they have themselves furnished? Certainly such value can go no further than the actual cost of reproducing that business.

It will be noticed that both the Alvord and Wisconsin methods give the greatest going value to those plants which have had the longest and hardest struggles to build up their business, while such plants are actually worth the least as commercial propositions. Prosperous plants, with large business quickly established, have the least going value, though far more attractive to the investor. The same is true as regards rates. A high schedule usually means low going value, while low rates increase going value.

With such wide divergencies of opinion among thoughtful and fair-minded men, it is not strange that much effort has been devoted to the finding of better and simpler methods. Nor is it strange that, despairing of success, shorter methods, less logical, perhaps, but giving due recognition to the underlying principle, should find favor. Some of these may be noted:

In one of the most important cases of recent years, in the hands of men of great ability, the results of various methods of computation were all found to be reasonably close to one year's gross revenue, and that sum was finally agreed upon.

In the recent Staten Island case the going value was arbitrarily fixed at $10 per service.

In Canada a flat addition of 10 per cent is made to the physical value to cover all the intangible values. See Municipal Acts of Ontario, third edition, VII, chapter 19, section 566, sub-section 4, clause (a2), which reads:

"In any arbitration under Clause (a) hereof to determine the price to be paid for the works and property of a gas or water company, the arbitrators shall determine the actual value of such works and property, having regard to what the same would cost if the works should be then constructed or the property then bought, making due allowance for deterioration and wear and tear, and making all other proper allowances, but not allowing anything for prospective profits or franchise, and shall increase the amount so ascertained by 10 per cent thereof, and such increased amount shall be the amount which the arbitrator or arbitrators shall award as the price to be allowed for the said works and property."

In drawing a new water contract at Mexico, Mo., the author recently adopted a somewhat similar idea, as follows:

"Purchase by City.—The city shall have the right to acquire by purchase all the property of the grantee actually used and useful for the convenience of the public at any time after the expiration of fifteen (15) years from the passage and approval of this ordinance by public vote, upon giving one year's notice to the grantee and upon paying therefor in cash the then cost of duplication, less depreciation of said property, with ten per cent (10 per cent) additional thereto as compensation for earning power, franchise value, going, contingencies and all other intangible values of every nature whatsoever."

Mr. Alvord's concluding remarks indicate a preference for using the actual cost of the existing plant, where it can be ascertained, as the basis of fixing rates, rather than the present cost of reproduction less depreciation, because of the exceeding complexity of the computations. It may be questioned whether many appraisers will follow him here. The idea is fundamental that present values and rates must be based on present-day conditions. Nor is it usually difficult for able, experienced and fair-minded appraisers to agree with reasonable closeness on physical values.

When the intangible values are taken up, the situation, as has been shown, is far different. Here, if anywhere, simple and direct methods, appealing more strongly to the average man's ideas of fairness, are needed. And from this standpoint the simple methods used above are not without merit.

PETROLEUM IN 1909—DECREASE IN PRODUCTION.

According to reports received by the United States Geological Survey, the remarkable rate of increase in the production of petroleum that extended through 1907 and 1908 was checked in 1909.

The total production for the United States in 1909, as estimated by David T. Day, of the Geological Survey, was between 173,000,000 and 178,000,000 barrels, as against 179,572,479 barrels in 1908. The decrease was less than had been expected in view of the great accumulation of stocks during the preceding year. This accumulation occurred entirely in States east of the Rocky Mountains that have no trade connection with California, and this State therefore showed a great gain, in which nearly all its pools participated.

California now stands first in oil production, producing fully 10,000,000 barrels more than Oklahoma, which ranks second. Developments begun in 1908 continued with increasing rapidity in 1909, many sections producing wells of large capacity.

One of the important events of the year—an event that created excitement in oil circles—was the drilling in September of the Silver Tip well on Section 6, Coalinga field. This is said to be, with the possible exception of the Hartnell well, of the Union Oil Company, drilled at Santa Maria in 1904, the greatest well ever drilled in the State. Other important developments have extended the Coalinga field to the west and south. Successful wells drilled in the Sunset, Midway, and other districts show the wonderful richness of the oil fields of the State. During 1909 several pipe lines were under construction to carry the increasing product, and although no exact statement can yet be made as to the total production there was undoubtedly a very substantial gain over the output of the previous year and a satisfactory increase in price.

WATER POWER RESOURCES OF THE GREATER NORTHWEST.[1]

BY O. L. WALLER, C. E.

With the Olympic mountains west of the Sound, the Cascades extending from north to south across the State, the Blue Mountains in the southeastern part of the State, and the Bitter Root and Rocky Mountains on the east furnishing lofty watersheds covered with perpetual snows, the power of streams of Washington is destined to add very considerably to its material growth.

The Columbia River, with its many large tributaries from Montana, Idaho and British Columbia, draining an area of 250,000 square miles, and drawing its supply from the snow fields of great mountain ranges, affords large possibilities for power developments. The annual minimum flow above Kettle Falls is reported as ranging from 19,000 to 30,000 cubic feet per second. This is a run-off from a drainage area of 63,160 square miles, of which 10,000 to 12,000 square miles is lake surface. At Kettle Falls the drop is 37.5 feet over a dike of rock, making a dam and power development extremely simple. With some storage the energy of these falls may be safely rated at 100,000 horsepower.

At Rock Island there is a fall of 72.5 feet in 8,000 feet, and a minimum discharge ranging from 23,000 to 34,000 cubic feet per second. The energy now wasted at this point amounts to 190,000 horsepower.

At Cabinet Rapids the fall is 10 feet in 8,000 cubic feet, and the energy equals 26,000 horsepower. At Priest Rapids the fall is 72 feet in 10 miles, and the energy of the stream is 188,000 horsepower.

In the section known as the Grand Dalles, which includes the cascades at Celilo, Ten-Mile Rapids, The Dalles, Three Mile Rapids and Two Mile Rapids, the fall is 80 feet, 20 feet of which is a sheer fall at Celilo. The minimum flow is rated at 26,000 to 37,000 cubic feet a second and the minimum energy of the stream is 236,000 horsepower, of which the fall is 24 feet in 3,000 feet, and the minimum energy of the stream is 71,000 horsepower.

Besides the large falls and cascades referred to, there are many others from Kettle Falls on down to Rock Island. While the Snake river has much swift water, the removal of dangerous rocks would make it navigable from its mouth to some distance above Lewiston, Idaho, and consequently it does not afford many promising power sites.

The power in the Spokane River has already been developed in several places, namely, Post Falls, the city pumping station at the series of rapids and falls at Spokane, and at a point nine miles below Spokane, and at a point opposite Reardan. In all 100,000 horsepower has been developed. Some of this acts directly on the turbines of the city pumping plants or of flour, feed and saw mills. The greater part, however, is converted into electricity at high voltage and transmitted long distances for light and power. In general, nearly all the light and power used in the State, with the exception of that developed by the lumber industries, which burns slabs, edgings and sawdust, is supplied from hydroelectric developments.

Most of the towns and cities in the Inland Empire are supplied with light and power from the Spokane River, while interurban railways supplied with power from the same source are rapidly threading the rich wheat and produce belt of Washington and Idaho.

The fall of the Methow River is about 25 feet per mile, with a minimum discharge of 400 cubic feet a

Priest Rapids Power Plant in Columbia River.

[1] Pacific Builder and Engineer.

second. Along its course from Twisp to its mouth there are many fine power sites where dams could be thrown across the river and economical development be made.

The minimum flow from Lake Chelan is about 812 cubic feet a second, the fall 360 feet and the energy about 33,000 horsepower. The development here will be simple and quite inexpensive. If the lake storage were used to equalize the flow, the above could be greatly increased.

The minimum flow of the Wenatchee River is about 850 cubuc feet a second, only about 25 per cent of which is used for irrigation purposes, and that only in the lower valley. For 14 miles through the Tumwater canyon and before emerging into the agricultural valleys this stream is a raging torrent.

The Great Northern Railroad Company has almost completed a power plant at Chiwaukum, in the Tumwater canyon, where it will develop 10,000 horsepower with which to operate trains through the Cascade tunnel. There are yet great undeveloped power possibilities along the river, probably more than can be utilized for many years to come.

Since much of the water now used and much of the stored water later to be used in the Yakima Valley will be distributed to lands pretty well down the valley, it will be possible to develop a considerable amount of power from the water before it reaches the agricultural lands upon which it is to be used finally, and there is great need for such power for use in domestic industries and to be distributed over the densely populated irrigated districts for light and power.

There still remain opportunities to develop power along the lower Colville River, some of which are now in use. Large power installations have also been made along important streams in other parts of the State, particularly west of the Cascades.

West of Puget Sound, where the Olympic Mountains, with snow-capped peaks and heavy precipitation (100 inches a year), feed many small streams and rivers mostly within the National forests. Some of the streams fall several thousand feet in their rush to the ocean, affording many opportunities for power development.

Lake Chelan.

The streams winding their courses westward from the Cascade range through a jungle of forest and undergrowth furnish very many power sites. At some seasons of the year these rivers are torrents and at all times they carry large volumes of water. Already the great falls of some of them have been put under control and supply light and power to the coast cities and interurban electric lines. The development, however, has only commenced.

Other streams mentioned are the Okanogan, Entiat, Chelan, Walla Walla, Touchet and Snake Rivers and Mill Creek in the eastern and southeastern parts of the State.

WIRELESS TELEGRAPHY.[1]

BY GUGLIELMO MARCONI, D.SC., LLD.

The discoveries connected with the propogation of electric waves over long distances and the practical applications of telegraphy through space, which have gained for me the supreme honor of sharing the Nobel Prize for Physics, have been to a great extent the result of one another.

The application of electric waves to the purposes of wireless telegraphic communication between distant parts of the earth, and the experiments which I have been fortunate enough to be able to carry out on a larger scale than is obtainable in ordinary laboratories, have made it possible to investigate phenomena and note results often novel and unexpected. In my opinion, many facts connected with the transmission of electric waves over great distances still await a satisfactory explanation, and I hope to be able in this lecture to refer to some observations which appear to require the attention of physicists. In sketching the history of my association with radio-telegraphy, I might mention that I never studied physics or electrotechnics in the regular manner, although as a boy I was deeply interested in these subjects. I did, however, attend one course of lectures on physics under the late Professor Rosa, at Livorno, and I was, I think I might say, fairly well acquainted with the publications of that time dealing with scientific subjects, including the works of Hertz, Branly and Pighi.

At my home, near Bologna, in Italy, I commenced early in 1895 to carry out tests and experiments with the object of determining whether it would be possible by means of Hertzian waves to transmit to a distance telegraphic signs and symbols without the aid of connecting wires. After a few preliminary experiments with Hertzian waves I became very soon convinced that if these waves or similar waves could be reliably transmitted and received over considerable distances a new system of communication would become available, possessing enormous advantages over flashlights and optical methods, which are so much dependent for their success on the clearness of the atmosphere. My first tests were carried out with an ordinary Hertz oscillator and a Branly coherer as detector, but I soon found out that the Branly coherer was far too erratic and unreliable for practical work. After some experiments, I found that a coherer consisting of nickel and silver filings placed in a small gap between two silver plugs in a tube, was remarkably sensitive and reliable. This improvement, together with the inclusion of the coherer in a circuit tuned to the wave-length of the transmitted radiation, allowed me to gradually extend up to about a mile the distance at which I could affect the receiver.

Another, now well known, arrangement which I adopted was to place the coherer in a circuit containing a voltaic cell and a sensitive telegraph relay actuating another circuit, which worked a tapper or trembler and a recording instrument. By means of a Morse telegraphic key placed in one of the circuits of the oscillator or transmitter, it was possible to emit long or short successions of electric waves, which would affect the receiver at a distance and accurately reproduce the telegraphic signs transmitted through space by the oscillator. With such apparatus I was able to telegraph up to a distance of about half-a-mile. Some further improvements were obtained by using reflectors with both the transmitters and receivers, the transmitter being in this case a Righi oscillator. This arrangement made it possible to send signals in one definite direction, but was inoperative if hills or any large obstacle happened to intervene between the transmitter and receiver. In August, 1895, I discovered a new arrangement, which not only greatly increased the distance over which I could communicate, but also seemed to make the transmission independent from the effects of intervening obstacles.

This arrangement consisted in connecting one terminal of the Hertzian oscillator, or spark producer, to earth, and the other terminal to a wire or capacity area placed at a height above the ground, and in also connecting at the receiving end one terminal of the coherer to earth and the other to an elevated conductor.

I then began to examine the relation between the distance at which the transmitter could affect the receiver and the elevation of the capacity areas above the earth, and I very soon definitely ascertained that the higher the wires or capacity areas the greater the distance over which it was possible to telegraph.

Thus I found that when using cubes of tin of about 30 cms. side as elevated conductors or capacities, placed at the top of poles 2 meters high, I could receive signals at 30 meters distance, and when placed on poles 4 meters high, at 100 meters, and at 8 meters high at 400 meters. With larger cubes 100 cms. side, fixed at a height of eight meters, signals could be transmitted 2,400 meters all round.

These experiments were continued in England, where in September, 1896, a distance of 1¾ miles was obtained in tests carried out for the British Government at Salisbury. The distance of communication was extended to four miles in March, 1897, and in May of the same year to nine miles. Tape messages obtained during those tests, signed by the British Government officers who were present, are exhibited. In all these experiments a very small amount of electrical power was used, the high tension current being produced by an ordinary Rhumkoff coil. The results obtained attracted a good deal of public attention at the time, such distances of communication being considered remarkable.

As I have explained, the main feature in my system consisted in the use of elevated capacity areas or vertical wires attached to one pole of the high frequency oscillators and receivers, the other pole of which was earthed.

The practical value of this innovation was not understood by many physicists for quite a considerable period, and the results which I obtained were by many erroneously considered simply due to efficiency in details of construction of the receiver, and to the employment of a large amount of energy. Others did not overlook the fact that a radical change had been introduced by making these elevated capacities and the earth form part of the high frequency oscillators and receivers. Profgessor Ascoli, of Rome, gave a very interesting theory of the mode of operation of my transmitters and receivers in the Elettricista, Rome,

[1]The Nobel Prize Lecture, delivered December 11, 1909.

issue of August, 1897, in which he correctly attributed the results obtained to the use of elevated wires or antennas.

Professor A. Slaby, of Charlottenburg, after witnessing my tests in England in 1897, came to somewhat similar conclusions.

Many technical writers have stated that an elevated capacity at the top of the vertical wire is unnecessary.

This is true if the length or height of the wire is made sufficiently great, but as this height may be much smaller for a given distance if a capacity area is used, it is more economical to use such capacities, which now usually consist of a number of wires spreading out from the top of the vertical conductor.

The necessity or utility of the earth connection has been sometimes questioned, but in my opinion no practical system of wireless telegraphy exists where the instruments are not connected to earth. By "connecting to earth" I do not necessarily mean an ordinary metalic connection as used for ordinary wire telegraphs. The earth wire may have a condenser in series with it, or it may be connected to what is really equivalent, a capacity area placed close to the surface of the ground.

It is now perfectly well known that a condenser, if large enough does not prevent the passage of high frequency oscillations, and therefore in these cases the earth is for all practical purposes connected to the antennae.

After numerous tests and demonstrations in Italy and in England over distances varying up to 40 miles, communication was established for the first time across the English Channel between England and France in March, 1899. From the beginning of 1898 I had practically abandoned the early system of connection, and instead of joining the coherer or detector directly to the aerial and earth, I connected it between the ends of the secondary of a suitable oscillation transformer containing a condenser and tuned to the period of the electrical waves received. The primary of this oscillation transformer was connected to the elevated wire and to earth. This arrangement allowed of a certain degree of syntony, as by varying the period of oscillation of the transmitting antennae, it was possible to send messages to a tuned receiver without interfering with others differently syntonized.

As it is now well known, a transmitter consisting of a vertical wire discharging through a spark-gap is not a persistent oscillator, the radiation it produces is strongly damped. Its electrical capacity is comparatively so small and its capability of radiating energy so large that its oscillations decrease or die off with great rapidity. In this case receivers or resonators of a considerably different period or pitch are likely to be affected by it.

Early in 1899 I was able to improve the resonance effects obtainable by increasing the capacity of the elevated wires by placing adjacently to them earthed conductors, and inserting in series with the aerials suitable inductance coils.

By these means the energy storing capacity of the aerial was increased, whilst its capability to radiate was decreased, with the result that the energy set in motion by the discharge formed a train of succession of feebly damped oscillations. By a modification of this arrangement, excellent results were obtained.

In 1900 I constructed and patented transmitters which consisted of the usual kind of elevated capacity area and earth connection, but these were inductively coupled to an oscillation circuit containing a condenser, an inductance, and a spark gap, the conditions which I found essential for efficiency being that the periods of electrical oscillation of the elevated wire or conductor should be in time or resonance with that of the condenser circuit. The circuits consisting of the oscillating circuit and radiating circuit, were more or less closely "coupled" by varying the distance between them. By the adjustment of the inductance inserted in the elevated conductor and by the variation of the capacity of the condenser circuit, the two circuits were brought into resonance, a condition which, as I have said, I found essential in order to obtain efficient radiation.

Part of my work regarding the utilization of condenser circuits in association with the radiating antennae was carried out simultaneously to that of Professor Braun, without, however, either of us knowing at the time anything of the contemporary work of the other.

A syntonic receiver has already been shown, and consists also of a vertical conductor or aerial connected to earth through the primary of an oscillation transformer, the secondary circuit of which included a condenser and a detector, it being necessary that the circuit containing the aerial and the circuit containing the detector should be in electrical resonance with each other, and also in tune with the periodicity of the electric waves transmitted from the sending station.

It is also possible to couple to one sending conductor several differently tuned transmitters and to a receiving wire a number of corresponding receivers, each individual receiver responding only to the radiations of the transmitter with which it is in resonance.

At the time (12 years ago) when communication was first established by means of radio-telegraphy between England and France, much discussion and speculation took place as to whether or not wireless telegraphy would be practicable for much longer distances than those then covered, and a somewhat general opinion prevailed that the curvature of the earth would be an insurmountable obstacle to long-distance transmission, in the same way as it was, and is, an obstacle to signalling over considerable distances by means of light flashes.

Difficulties were also anticipated as to the possibility of being able to control the large amount of energy which it appeared would be necessary to cover long distances.

What often happens in pioneer work repeated itself in the case of radio-telegraphy—the anticipated obstacles or difficulties were either purely imaginary or else easily surmountable, but in their place unexpected barriers manifested themselves, and recent work has been mainly directed to the solution of problems presented by difficulties which were certainly neither expected nor anticipated when long distances were first attempted.

(TO BE CONTINUED)

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The Science of Appraising

Appraisers seldom agree as to the value of a public service plant. This is not because of individual bias, but is due to the lack of a uniform basis of valuation. Recently it has become customary to calculate rates for public utilities and to levy taxes on the companies furnishing them upon the estimated worth of the property. This estimate is often made by an arbiter, an engineer whose wide experience in designing, installing and operating such plants has qualified him to act in this capacity. If it were possible to assemble and co-ordinate the experience of a number of such arbiters, we would have the foundation upon which to build a new science, that of appraising.

Analysis shows that the value of any business is dual—the corporeal and the incorporeal. In bookkeeping, these are written as "furniture and fixtures" and "good will." In a public utility plant they are represented by the physical value and the franchise and going values. The first is tangible and readily calculated from the cost of replacing a similar plant, less the depreciation. The last two, being intangible, have been the bone of bitter contention.

It is frequently argued that a franchise, being a license gratuitously granted by the people, should not be capitalized by a corporation because the increased cost of service compels the people to pay the fixed charges on what was formerly their own property. But as the corporation pays taxes on its franchise, it feels justified in calling it an asset. The investment is made "not in the franchise, but under the franchise, and in the faith thereof." The courts have repeatedly recognized the franchise as property whose value depends upon its earning power. An average of many franchise valuations has been estimated by Henry Floy to be about one-third of the actual replacement value of the corporation's assets.

Finally, there is the going value, which is represented by an established or operating business, as distinguished from one that is merely ready for business. The part occupied by this element in the appraisal of public utility properties is admirably expressed elsewhere in this issue by Mr. William H. Bryan. His paper is largely concerned with a comparison of the rulings of the Wisconsin Commission and the suggestions in a previous paper by John W. Alvord. These differ essentially in their definition of the going value, the Commission's rulings being based upon the expenditure necessary to obtain a similar business and to cover losses until the plant is self-supporting, and Mr. Alvord's findings upon the cost of reproducing the gross income of an existing plant. Mr. Bryan suggests that some less logical, but shorter method, will meet with more general approval, and recommends that some definite percentage be adopted as a basis of valuation.

From the above it will be noted that the present tendency is toward an arbitrary standard. Such empirical rules are typical of all incomplete sciences. They suffice until better are found.

PERSONALS.

A. M. Hunt, consulting engineer, spent the past week in Southern California.

Thomas Mirk, of Hunt, Mirk & Co., is visiting San Diego, on engineering business.

Russell Dunn has been appointed City Engineer of San Francisco by Mayor P. H. McCarthy.

R. B. Daggett, manager Pacific Coast offices of the Electric Storage Battery Company, left San Francisco this week for a trip East.

C. P. Baird, president of the King City Water, Light & Power Company, spent the Christmas holidays in San Francisco.

C. L. Cory recently returned from a week's trip through Southern California, including Los Angeles and the Imperial Valley.

Edgar C. Gribble, chief electrician of the Fairmont Hotel, also has charge of the new plant of the Palace Hotel in San Francisco.

R. D. Holabird has returned to San Francisco from the East where he reports that business is showing great improvement.

Frank Thurber, superintendent of the San Jose Railway Company, came up to enjoy New Year's Eve and was a guest at the Palace.

Henry Parsons, superintendent of the San Jose, Los Gatos & Interurban Railway, of San Jose, spent Christmas in San Francisco.

A. G. Wishon, manager of the San Joaquin Light & Power Company, has returned to Fresno after spending Christmas and New Year's in San Francisco.

H. H. Sinclair, vice-president and general manager of the Great Western Power Company, left San Francisco for the East on December 29th for a short business trip.

Russell Walden, manager of the California Electrical Construction Company, who has been confined to his home by illness for the past four months, is now convalescent.

G. H. Hall has recently been transferred from the Boston office of the Sprague Electric Company to the motor and generator department in the general office, New York City.

"King" Haley, formerly a foreman at the Union Iron Works, is the new chief engineer at the Hotel St. Francis, San Francisco, taking the place of Chas. G. Hightower, resigned.

Arthur N. Cantril, formerly with the Denver Gas and Electric Company, and more recently with the Pueblo Gas Company, has been made general manager of the Spokane Gas Light Company, which was recently acquired by the Doherty interests.

F. A. Richards has been appointed manager of the car department of Pierson, Roeding Company of San Francisco, Pacific Coast agents for the J. G. Brill Company, vice O. L. Williams resigned. Mr. Richards will arrive in San Francisco before the end of January.

G. A. Richardson, who has for the past five years been superintendent of the Houghton County Traction Company, recently resigned to accept the position of traffic manager of the Seattle lines. As a testimonial of their regard, the trainmen of the company presented Mr. Richardson with a handsome remembrance.

A. C. Sprout has returned to San Francisco from Dunsmuir, where he was engaged as engineer in connection with the installation of electric power transmission apparatus in the Southern Pacific Company's shops. An extension of the Siskiyou Electric Light & Power Company's transmission lines was made in order to secure a supply of power.

NEW CATALOGUES.

Smith-Booth-Usher Co., 212 S. Los Angeles street, Los Angeles, Cal., are distributing a pamphlet that shows the saving in power effected by using the International Amet Oil Gas Producer.

The Fritchle Automobile and Battery Company, Denver, Colo., has issued a well-illustrated booklet describing in detail a 2140-mile tour made in a Fritchle "100-mile" electric vehicle in winter from Lincoln, Nebr., to New York City, thence to Washington, D. C.

Holophane Illumination for December, 1909, from the Holophane Company contains useful data on lighting auditoriums, garages and windows. Announcement is made that hereafter the metric system is to be adopted in all publications from this company.

Circular No. 1506 from the Westinghouse Electric & Mfg. Co. consists of an interesting and valuable paper on "Recent Types of Arc Lamps and Their Operation," by C. E. Stephens, This paper was read before the National Electric Light Association Convention in June, 1909.

Bulletin No. 117 of the Bristol Company, Waterbury, Conn., describes and illustrates recording gages for pressure and vacuum and also water-level gages. In these gages there are no multiplying devices, the recording pen arm being attached directly to the pressure tube.

A little folder, No. 3884, recently issued by the General Electric Company, is interesting inasmuch as it compares the Tungsten and carbon sign lamps, and shows plainly the advantages to be derived by the use of the former. It describes also the manner in which an ordinary sign may be transformed into an illuminated sign.

In a n attractive pamphlet "The Dawn of a New Era in Lighting," the General Electric Company takes up the history of light from the tallow dip to the tungsten lamp. The comparison of cost of this with other illuminants is taken up in detail. The pamphlet, which is numbered 3885, should be of interest to both the producer and consumer of current.

A new and enlarged edition of "Feed Water Filtration" is being distributed by James Beggs & Co., 109 Liberty street, New York. This book explains how oil, dirt, etc., get into feed water, what damage they do within the boilers, and how to remove such impurities before they can occur. The Blackburn-Smith Feed Water Filter and Grease Extractor is described in detail.

The Westinghouse Diary for 1910 from the Westinghouse Elec. & Mfg. Co. maintains the high standard set by its predecessors. Substantially and handsomely bound in tan leather its 96 pages of condensed electrical data, arranged for convenient reference, is invaluable to the engineer. The diary for 1910 and the maps of the world which are included continue to make it a most useful pocket companion.

Bulletin No. 4705, devoted to the Curtis Steam Turbines for low pressure and high pressure has been issued by the General Electric Company, and contains considerable information which should be of interest and value to the central station manager. As the subject indicates, the publication deals with turbines of both the low pressure and the mixed pressure types, and those with horizontal and with vertical shafts.

The Ohio Brass Company December bulletin is devoted to electric railway and mine haulage material. The feature of this issue is an abstract of the paper on the Cascade Tunnel electrification, presented before the American Institute of Electrical Engineers by Dr. Cary T. Hutchinson. The Ohio Brass Company designed the overhead construction and manufactured all the overhead material used for this installation. This bulletin also contains an illustrated description of the company's factory.

NEWS OF THE STATIONARY ENGINEERS

PREAMBLE.—This Association shall at no time be used for the furtherance of strikes, or for the purpose of interfering in any way between its members and their employers in regard to wages; recognizing the identity of interests between employer and employe, and not countenancing any project or enterprise that will interfere with perfect harmony between them.

Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the business of the Association, and at all times preference shall be given to the education of engineers, and to securing the enactment of engineers' license laws in order to prevent the destruction of life and property in the generation and transmission of steam as a motive power.

California.

No. 1. San Francisco, Thursday, 172 Golden Gate Ave. Pres., P. L. Ennor. Sec., Herman Noethig, 816 York St.

No. 2. Los Angeles. Friday, Eagles' Hall, 116½ E. Third St. Pres., J. F. Connell. Fin. Sec., Harry Notthoff, 1307 Winfield St. Cor. Sec., W. T. W. Curl, 4103 Dalton Ave.

No. 3. San Francisco. Wednesday, Merchants' Exchange Bldg. Sec., David Thomas, 914 O'Farrell St.

No. 5. Santa Barbara. Geo. W. Stevens, 2417 Fletcher Ave., R. R. No. 2.

No. 6. San Jose, Wednesday. Pres., W. A. Wilson, Sec., Lea Davis, 350 N. 9th St.

No. 7. Fresno. Pres., A. G. Rose. Sec., E. F. Fitzgerald, Box 651.

No. 8. Stockton. Thursday, Masonic Hall. Sec., S. Bunch, 626 E. Channel St. Pres., H. Eberhard.

Oregon.

No. 1. Portland. Wednesday, J. D. Asher, Portland Hotel. Pres., B. W. Slocum.

No. 2. Salem. A. L. Brown, Box 166.

Washington.

No. 3. Tacoma. Friday, 913½ Tacoma Ave. Pres., Geo. E. Bowman. Sec., Thos. L. Keeley, 3727 Ferdinand St., N., Whitworth Sta.

No. 4. Spokane. Tuesday. Pres., Frank Teed. Sec., J. Thos. Greeley, 0601½ Cincinnati St.

No. 6. Seattle. Saturday, 1420 2d Ave. Pres., H. R. Leigh. Sec., J. C. Miller, 1600 Yesler Way.

Practical letters from engineers and news items of general interest are always welcome. Write your items regardless of style. Communications should be addressed to the Steam Engineering Editor.

PRACTICAL MECHANICS.

Paper No. 2—Names and Terms.

In order that we may be intelligently understood in the use of certain technical terms and expressions it will be well to bear in mind the following definitions:

Velocity—Theoretically this term is used to denote the rate of change of position of a moving point. Velocity implies direction, as well as quantity of motion. It may be either variable or constant.

When constant we denote the velocity as uniform motion and usually express it in terms of feet per second. In this case the distance passed over in a given time divided by that time gives the velocity e. g. 10 ft. traversed in 5 secs. equals velocity of $\frac{10}{5}$ or 2 ft. per second.

When the velocity is not constant we may divide the space passed over in a very short time by that time interval, and thus obtain the average velocity for the instant concerned, as for instance 0.3 ft. traversed in 0.1 sec. $= \frac{0.3}{0.1} = 3$ ft. per sec., the velocity for that particular tenth of a second.

Mathematically this reduction of the time and space values may be continued until the quanities become infinitesimal. These are then sumnated or integrated, as it is called to ge a general expression for the velocity. The numerical value at any instant is then found by substituting the known quantities in this general expression. This value really is the length that would be passed over in the next unit of time if the law of change for speed and direction were at that instant interrupted. This extreme exactness is rarely necessary, in the study of mechanism, and will not be further discussed here.

Velocitites may be classified as linear and angular, either type of which may be constant or variable.

By *linear velocity* is meant the rate of motion in a uniform direction along any straight line.

By *angular velocity* is meant the rate of motion of a point at a unit distance from the center of angular motion. Angular velocity is expressive therefore in terms of the angle swept out during the time interval considered. An arc of a circle equal in length to the radius of the circle is called a radian. Calling the ratio of circumference to diameter, π then since the diameter is twice the radius, there are 2π radians in every circle. Now, if the radius of the circle be taken as unity then a velocity of 2π radians per sec. is equal to one revolution per second.

Velocity-ratio is the term used to denote the ratio of two linear or two angular velocities or, in some cases of a linear and an angular velocity.

Revolution is the designation for a complete turn while rotation applies to any portion of a turn and has to do with the direction of the turn.

Driver and *follower*—In any elementary combination of mechanism one piece always drives the other, the one therefore being called the driver and the other the follower.

Directional relation—This term has reference to the relation of the directions of motion of driver and follower. If one never reverses its direction of motion unless the other does also, the directional relation is constant, otherwise it is said to be variable.

MOTION.

Kinds of Motion—In general the position of a body in motion is known if the positions of three of its points are known. If, now, one of these three points is fixed in space the motions of all other points are at once limited to the surfaces of concentric spheres. This is known as Spheric Motion. The application of spheric motion to mechanics is in this general case, rare; but if we consider the fixed point as removed infinity, that is, such that any finite portions of the concentric spheres become planes, we have a very common form of application. This is called Uniplanar Motion. The majority of machine motions are of this type, and the solution of these problems involves only plane geometry, all calculations being referred to a reference plane.

KINDS OF UNIPLANAR MOTION.

Uniplanar Motion consists of either *Pure Rotation*, or *Rectilinear Translation*, or both.

Pure Rotation is the motion resulting when in addition to fixing one point at infinity the body is still further constrained by fixing a second point in the reference plane, or at any finite distance from it. In this case all other points in the body travel in a system of concentric circles about the line connecting the two fixed points.

Rectilinear Translation is the motion resulting if the second fixed point above discussed is removed to infinity in any direction other than at right angles to the reference plane.

The concentric circles then become, within any finite space, a system of straight lines parallel to the line of intersection of the two reference planes.

Some illustrations may serve to aid the understanding of this development and classification of motion. The old familiar fly-ball engine governor would, if the arms were pivoted at the center of the axis of rotation, or of the spindle, be a case of spheric motion.

The movement of a ship at sea is practically uniplanar motion since the center of the earth (the fixed point removed to infinity) is sufficiently removed from the sea-level to give the surface the appearance of a plane.

If now a moving ship at sea be constrained by a tight rope attached to some fixed point, as an anchor, its motion can be only in a circle about the anchor or really about the axis extending through the center of the earth and the anchor. This is pure rotation.

Now extend the rope several miles to a shore anchorage, then any brief motion of the ship will be possible only in a straight line at right angles to the direction of the rope. This will be a case of rectilinear translation.

In dealing graphically with problems in uniplanar motion it is convenient to make use of a system of diagraming and notation known as the rectangular co-ordinate system. In this system two axes of reference are assumed intersecting in a point.

This point is called the origin and is usually designated by the letter (O). One axis extending up and down the paper is called the ordinate or (Y) axis. Values up are taken as positive and those down as below O, are negative. The other axis at right angles to the Y axis is called abscissa or (X) axis. Values to the right of O are positive and to the left negative.

THE INSTANTANEOUS CENTER.

In a body moving with uniplanar motion suppose the direction of motion of two of its points is known. Now erect perpendiculars to these lines of direction at the points considered. The intersection of these perpendiculars will be a point about which the body is for the instant rotating. This point is called the instantaneous center.

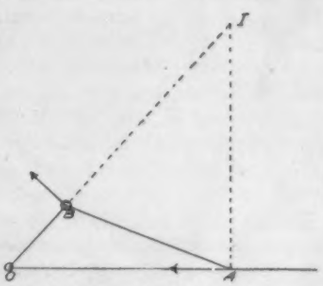


Fig. 1.

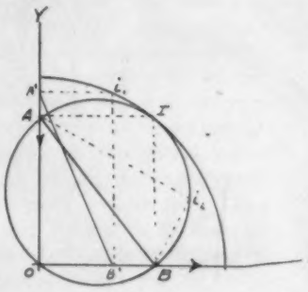


Fig. 2.

Suppose (O B) in Fig. 1 to represent an engine crank with shaft at O. Let A B represent the connecting rod. The arrows as drawn indicate the directions of motion of the two points of the rod A and B at the instant under consideration. Perpendiculars to these two directions of motion are shown intersecting at I the instantaneous center and the connecting rod is at that instant moving as though turning about I as a center.

This point may be easily determined for any series of positions, and if these positions are chosen sufficiently close together the successive position of the instantaneous center will become a curve. This curve is called the centrode of motion. Depending upon whether the motion is based upon fixed axes in space or upon axes fixed in the body itself the centrodes become fixed (space) centrodes, or body (moving) centrodes. An example of this is the following: See Fig. 2.

Consider the line A B whose extremities are constrained to move along the axes O Y and O X. By plotting successive positions of the instantaneous center it will be found that the fixed centrode is a circle of radius equal to A B and with center at O. By further plotting with reference to the line A B the successive positions (*i. e.* as i_2 instead of i_1) taken up by the instantaneous center the moving centrode is found to be another circle A O B, whose diameter is one-half that of the fixed centrode. This circle rolls on the inner side of the fixed centrode as the line A B assumes its various positions. Every point of the circumference of the moving centrode describes a diameter of the fixed centrode. This is a straight line hypocycloid.

SAN FRANCISCO, NO. 1.

The National Association of Stationary Engineers, San Francisco, No. 1, held an informal smoker and house warming in their new hall at 172 Golden Gate avenue, on the evening of December 30th. The president of San Francisco No. 1, Mr. P. L. Ennor made the opening address and extended a cordial welcome to all present and to partake of the hospitality of this association. At this social gathering there was present the sister Association, California No. 3, with many of their officers and members. The following contributed their services for the above function: Mr. Ed. Healey, the famous and congenial comedian; R. H. Hunt, the Bohemian Kid; Chas. H. S. Pratt with his songs and recitation lubricated with axle grease; Cecil C. Cline, song and cornet solo; Frank Willard, song and story; Ray Broulette, pianist and songs. Speeches were made by the following: Past President, J. W. Maher, of San Francisco No. 1; W. N. Munroe, president of California No. 3; David Thomas, C. C. Elsasser, our genial manager of the late Mechanics' Fair; Mr. Matthews, J. L. Davis, James Carr and many others. Notwithstanding the inclement weather, it was in the wee small hours of the morning before the guests repaired to their respective homes. H. W. NOETHIG.

QUESTION BOX.

Question: In putting in a new shaft, give a brief rule for adjusting the eccentric.

Answer: Put the crank on its top center with the valve at its proper lead at the top. Next fasten the sheave with set bolts to keep the valve lead secure; when all is connected, then, after a turn of the engine, see if the valve has the proper lead at the bottom when the crank is on the bottom center. If such is the case, mark the key ways and key on the sheave.

Question: Give a simple rule for finding the total heat in steam and an example of same.

Answer: Multiply temperature (or sensible heat) of the steam by .3 and add it to 1115°.

100 lbs. by the gauge is 115 gross, the 15 being approximately the weight of the atmosphere, and 115 gross has (by a reference to steam tables) 338° of heat, hence:

$$338 \times .3 = 101.4 + 1115° = 1216.4 = \text{total heat}$$

338.0 sensible heat

878.4 latent heat.

Question: What gain is there in using steam at 100 lb. and by expansion making the mean effective pressure 70 lb. over, using steam of 70 lb. throughout the entire stroke?

Answer: Using a cylinder with a volume of 1 cubic foot, and an initial pressure of 70 lb. continued throughout the stroke, would be using, at each stroke, a cubic foot of 70 lb. steam, or a weight of .201 lb. Should the initial pressure be 100 lb., a cut-off of ⅜ cubic feet therefore equals .099, so that only .099 lb. would be used, against .201 lb. of the lever pressure steam, as in the first case. Thus, by working steam expansively, you have a gain of .201—.099=.102 lb. at each ½ stroke.

Question: What is the best ratio of areas for a steam pump?

Answer: The steam piston should have about 2¾ times the area of the water piston. There being no mechanical purchase in favor of the steam piston, it must have the greater area of the two, otherwise the pressure on the water piston would equal the pressure on the steam piston and the pump would refuse to work.

Question: What is meant by the number of an indicator spring?

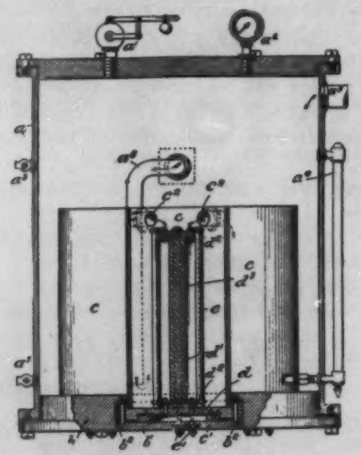
Answer: The number marked on a spring (several of which are furnished with each indicator) is designed to show the number of lb. steam pressure on the boiler at which it is to be used; thus, a 30 lb. spring is one in which a pressure of 30 lb. will cause the piston inside the indicator to rise one inch above the atmospheric line of the diagram.

TRADE NOTES.

An important decision was rendered on November 12th by the U. S. Court of Appeals for the First Circuit, sustaining the Thalacker patent 502,541 which covers substantially all forms of indicating enclosed fuses. In the opinion of the court, as stated by Judge Lowell, "The gist of the Thalacker patent consists in the combination with these old elements (the main fuse and its casing) of an auxiliary fuse whose condition is at all times conveniently observed, so that by reasonable inference the condition of the main fuse may be known." The court held "The invention goes beyond the mere details shown and the patent should receive a construction correspondingly broad." The above decision was rendered in the suit brought by the General Electric Company against Fred B. Smith, sales agent for the Sachs fuses.

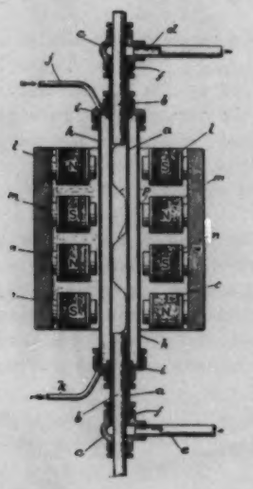
PATENTS

944,050. Electrical Steam-Generator. Eleazer I. Rains, New York, N. Y. An electrical steam generator, comprising a common shell or casing, a plurality of independent water containers therein, each adapted to receive and hold a body of water separate from and independent of that in each of



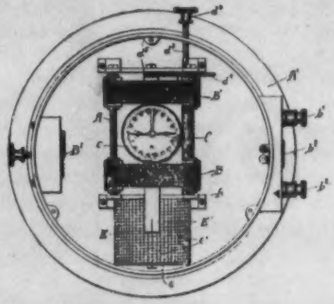
the other containers, and communicating with a common steam space, and a plurality of independent electrical heating elements distributed in the several water containers, whereby the water in each container may be heated independently of that in the other containers.

943,661. Production of Oxids of Nitrogen from the Air. Francis I. du Pont, Wilmington, Delaware, assignor to She E. I. du Pont de Nemours Powder Company, Wilmington, Del. An apparatus for producing oxids of nitrogen from the air, comprising in combination a cooling surface, which is a



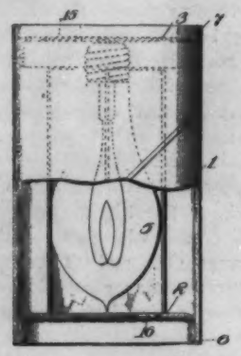
non-conductor of electricity, in contact with which the air to be acted on is adapted to pass, electrodes between which an arc longitudinally with respect to said surface is adapted to be produced, and a plurality of oppositely placed rotary magnetic fields extending longitudinally between the electrodes.

944,459. Instrument for Locating Grounds and Breaks in Electric Circuits. Matthew J. Myers, Syracuse, N. Y. In an instrument for locating an unknown portion of a circuit to be tested, the combination of oppositely-acting magnetizing members adapted to be connected respectively to the branches of the circuit, a magnetizable member subject to the differential influence of the magnetizing members, said magnetizable member being movable automatically relatively to the magnetizing members, means for varying the relative position of



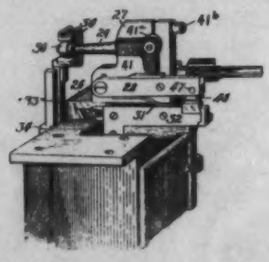
the magnetizing and magnetizable members, and means controlled by the variation of the relative position of the magnetizing and magnetizable members for indicating the position of the unknown portion of the circuit.

944,616. Package for Frangible Articles. Charles F. Jenkins, Washington, D. C., assignor to Single Service Package Company. In a package for frangible articles the combination of a body portion; a pair of flanged, cup-shaped closures



therefore having their flanges pointing in the same direction and fitting the interior surface of said body portion; and an angular container also fitting the interior of said body portion and resting between said closures, substantially as described.

943,861. Electric-Welding Machine. Alvin E. Buchenberg, Toledo, Ohio, assignor to The Toledo Electric Welding Company, Toledo, Ohio. In a machine of the class described, the combination of a plurality of work-gripping levers, and



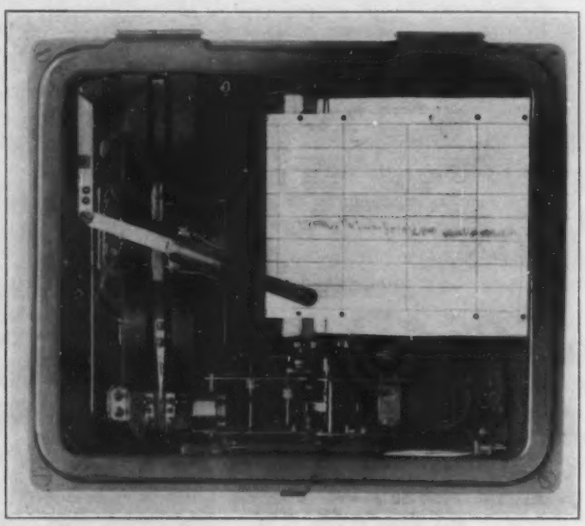
mechanism movable to effect a positive oscillation of the levers in unison to grip the work and capable of permitting differential movements of the levers as the varying thickness of the work may require.

INDUSTRIAL

HOW GRAPHIC-METER ANALYSIS OF SUB-STATION LOAD RENDERED POSSIBLE REDUCTION IN GENERATING EQUIPMENT.

An example of the value of the graphic recording meter for analyzing power loads was recently shown in a sub-station which supplies power to the terminal yards of a large railroad system. In this instance, as a result of the application of the meter, it was found possible to reduce the capacity of the machines operating by more than half, thereby diminishing operating expenses and improving the efficiency and load factor of the remaining generating equipment.

The sub-station referred to contains one 37½ k. w. and two 25 k. w. motor generator sets. These supply direct current at 250 volts to three turntables and one small crane. Each of the turn tables is driven by a 22 h. p. series motor with rheostat controller, and is capable of turning a locomotive 180 degrees, or end for end, in one minute. The crane is about five tons capacity and subject to very intermittent service, so that its operation has little effect on the total station load.



Westinghouse Graphic Recording Meter.

The turntables are held ready for service at all times. Rush hour periods occur in the morning and evening, and at these times the tables are usually very busy. A locomotive to be turned goes to the nearest unoccupied table, and in this way it is rarely the case that the two turntables are started at once, although two or three may be in operation at the same time.

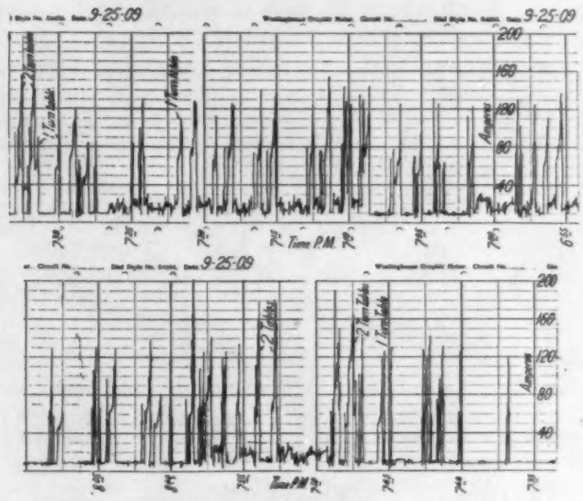
Before the study of the actual load conditions had been begun, it was customary to operate all three motor generator sets during the rush hours. At these times the violent oscillation of the needles of indicating meters on the generating panels, striking against the stops, seemed to indicate that more generating capacity was needed. In order to determine this latter question definitely, a Westinghouse graphic recording meter was obtained and inserted in the main feeder. The tests covered a week's careful study, during which time the load on the station was continuously recorded. That section of the curve reproduced herewith was secured during one of the rush periods. To obtain a clear record, a paper speed of 24 inches per hour was used.

The record shows that the average peak encountered during the starting of a turntable is 120 amperes. This drops to a value of from 50 to 70 amperes during operation, after the table has been accelerated. The maximum peak noted was about 180 amperes at the time of starting two turntables simultaneously.

As the full load current of the 37½ k. w. motor generator set alone is 150 amperes, it becomes very clear that the existing station capacity is ample to handle the present service besides a large future increase.

Since the tests it has been found necessary to operate only the one largest unit, and the former practice of running all three sets as accordingly been discontinued. The result has been improved operating economy, efficiency and load factor.

This example thus cites an instance where, in spite of a suspected insufficient station capacity, it was demonstrated that less than half the equipment already installed was needed for the existing demand. The graphic indicating meter is equally impartial in showing up overloaded apparatus, and often performs valuable service in indicating unsuspected load conditions which give rise to excessive heating and impaired regulation and efficiency, the cause of which cannot otherwise be traced.



Graphic Meter Record of Motor Driven Locomotive Turntable Loads.

The important results obtained from graphic meter analysis of motor driven machines and apparatus have been repeatedly shown. Loss of time has been eliminated, and the productiveness of both machine and operator largely increased as a result of the definite location of "low spots" in the motor load curve.

Experience has proven that in almost every power operation there may be considerable unknown and unnecessary losses, which may be promptly localized by analyzing the graphic meter curve, and remedied with resultant increased production or decreased operating expense.

TRADE NOTE

The Western Electric Company is making rapid progress with the installation of the power generating plant for the St. Francis Hotel. The plant will consist of four Western Electric, three-wire, direct-current generators, with a combined capacity of 825 k. w., controlled by switchboards of the remote controller type.

NEWS NOTES

FINANCIAL.

SPOKANE, WASH.—Directors of Washington Water Power Company have asked to increase stock $5,000,000. Action will be taken March 15 next.

SACRAMENTO, CAL.—The Board of Trustees has ordered the judiciary committee to prepare the necessary ordinance calling for a bond election to raise $666,000 for a filtration plant on the Mull Tract.

NEWPORT, CAL.—At a special election this place voted $49,000 in bonds for water works and $25,000 for gas works. The city will take over the plans and system of the Newport Water Company, and Home Gas & Electric Company.

NAPA, CAL.—Bids are being received at the office of the Napa City Water Company for the purchase of $22,500 20-year 5 per cent semi-annual first mortgage bonds, by W. G. Thompson, secretary. Accrued interest to be paid by purchaser.

TACOMA, WASH.—The City Council has ordered a special election to pass upon the Green River water supply as the best proposition of supplying Tacoma with a gravity system. It will require the issue of over $2,000,000 in bonds to finance the new system.

ST. HELENS, ORE.—The water commission at its last meeting entered into a contract with Morris Bros. of Portland, for floating $40,000 of water bonds, proceeds to be used for the construction of a water system. The bonds draw six per cent interest and sold at par.

SAN FRANCISCO, CAL.—The proposals to issue bonds to the amount of $1,900,000 for the construction of a municipal electric railway on Geary street and $120,000 for a similar road on Market street from Sutter to the ferry carried at the election December 30th.

SAN FRANCISCO, CAL.—The City Electric Company has decided to pay a monthly dividend of 25c per share of issued stock of par value of $100. The company's plant began operations November 15, 1907, and its capacity has just been increased by the installation of a 12,000 k. w. steam turbine generator.

PASADENA, CAL.—A resolution declaring that the interests of Pasadena demand municipal ownership of water plans was passed at a special meeting of the City Council last week. An ordinance calling for a bond election for $1,200,000 of either 4½ or 5 per cent bonds and setting the date of the election either January 26th or between that and February 1st, will be passed. Prices to be paid for three water companies are: Lake Vineyard, $386,000; West Side, $301,000; North Pasadena, $131,000. In addition to this the bonds will cover $200,000 betterments.

INCORPORATIONS.

ROSWELL, N. M.—Grant Oil & Gas Co. of Roswell, $1,000,000.

SPOKANE, WASH.—Washington Southern Tel. Co. of Spokane, $100,000, by C. M. Cooley, L. V. Gray, C. N. Thomas, C. R. and D. V. Cushman.

LA MESA, CAL.—Cholla Mutual Water Company, with a capital of $4000. The company has incorporated for mutual benefit of residents and property owners in the Stenger tract. Directors are C. C., H. C. and D. F. Park, W. L. Maxwell, etc. all of La Mesa. Principal place of business is at La Mesa.

MARSHFIELD, ORE.—Articles of incorporation have been filed with the county clerk by the Union Traction and Terminal Company, organized to build car lines in North Bend and Marshfield, also connecting the two cities. Incorporators are: J. M. Blake, G. W. Kaufman and R. O. Grages; capital stock, $1,000,000.

CITY OF MEXICO.—The Guadalajara Gas, Operating & Construction Co. has been organized in Los Angeles, Cal., to take over concession for a gas plant in Guadalajara secured by J. Guillermo Dominguez. H. W. Burkhart is vice president and general manager of the new company. Work will be started early in the new year. H. N. Sessions, a Los Angeles gas and electrical engineer, is responsible for the organization of the new company.

TRANSMISSION.

SPOKANE, WASH.—Spokane & Inland Empire Company, will construct new transmission lines from Greenacres to Coeur d'Alene and Hayden Lake.

ENTIAT, WASH.—George Brown of Chelan Falls and J. G. Kennedy of Waterville are soon to start work on their new power plant at the mouth of the Entiat.

BOISE, IDADO.—It is reported that the Western Electric Company is surveying a site for a power dam on the Snake River at Halls Falls, west of Mountainhome.

CHICO, CAL.—The Sacramento Valley Power Company has a large force of men setting poles and placing wires for the line between Chico and Redding. The line is eighty miles long, and will be completed about January 1st.

AUBURN, CAL.—The Hydro-Electric Company's plant at Horseshoe Bar on the American River was recently completed. This plant is owned personally by John A. Britton. It will furnish power for mining and other industries in the vicinity of the plant.

KALISPELL, MONT.—After much arbitration a compromise was reached by the Northern Idaho & Montana Power Company and the City Council of Columbia Falls and a fifty year franchise for the furnishing of electric light to the city was granted the company.

TWIN FALLS, IDAHO.—The City Council has granted a blanket franchise to the Twin Falls Electric Railway, Light & Power Company, of which F. D. Kimball is the head carrying the right to erect poles, etc., for the distribution of electric light and power within the city.

SAN FRANCISCO, CAL.—Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., up to January 18, 1910, and publicly opened immediately thereafter, to furnish at the naval training station, San Francisco, one centrifugal pump and motor.

REDDING, CAL.—The Mountain Copper Mining Company has taken its most decisive step, just closing a contract with the Northern California Power Company, to build a new and heavy power transmission line from this city to the Keswick smelter. The line will be bigger than the one to Kennett and will be constructed at a cost of $150,000.

NEW YORK.—The Mexican Northern Power Company, held a meeting in Montreal in November and increased its capital stock. The company has obtained valuable concessions for the erection on the Conchas river in Chihuahua, Mexico, of extensive hydroelectric and irrigation projects. An immense dam will be constructed, which will probably be the largest in the world. There will be two transmission lines, one to the city of Chihuahua and one to Parral. C. F. Greenwood is president and E. G. Greenshield is vice president of the company.

SALT LAKE, UTAH.—With the expressed intention of increasing the height of the dam known as the Gunnison reservoir dam, to ten feet, and to store all surplus and unappropriated waters of the Sanpitch River and Six-mile Creek, Frank L. Capening of Provo has filed an application asking the right to appropriate from these streams 5,000 acre-feet of water. Under the application an area of 5000 acres in Sanpete County will be irrigated.

LODI, CAL.—Geo. E. Lawrence, chairman of the Board of City Trustees, is now in San Francisco negotiating with the different power companies relative to purchasing electric current by the city of Lodi. It has been stated on good authority that the American River Company is willing and anxious to furnish the city with light and power. The city has the money needed for a municipal system of light, power, water and sewerage, and if necessary a plant will be erected to generate electricity and pump water. The Trustees prefer, however, to purchase the current if satisfactory arrangements can be made with some company.

ILLUMINATION.

SIERRA MADRE, CAL.—The City Council has ordered the City Clerk to publish notice of the sale of the gas franchise applied for by S. S. Forney.

SANTA BARBARA, CAL.—The local lighting plant will make improvements in the old Merchants' Mutual plant and bring it up to the standard of plant now known as Edison No. 1.

LOS ANGELES, CAL.—The Board of Trustees has adopted a resolution to install four miles of additional street lighting service and 80 lights with copper service wire and tungsten lamps at a cost of $11,600.

CHEHALIS, WASH.—The City Council has passed an ordinance granting to W. W. Seymour and F. C. Brewer the right to erect and operate pipes in the streets for the transmission of heating and illuminating gas.

EUGENE, ORE.—Plans have been outlined by Manager J. H. Hartog, of the Commercial Club, for the augmentation of of the street lighting system of the city. Hartog has secured a contract with the Northwestern Corporation.

SAN MATEO, CAL.—Mr. Cunha's application for a franchise for an electric lighting system for the coast side has been brought up again by Archer Kinkaid and the necessary resolution has been passed ordering bids to be advertised for.

ALAMOGORDO, N. M.—Geo. Carl, proprietor of the Alamagordo ice factory, has formed a stock company for the purpose of putting in an electric power house at his ranch. The Company will be known as the Alamogordo Consumers' Light & Power Company.

FORT BAYARD, N. M.—Sealed bids in triplicate for the electric light wiring and electric light fixtures for one double set of hospital sergeant's quarters and one power plant with machinery for a refrigerating and electric light system at this post will be received until February 15th.

TACOMA, WASH.—Sealed proposals will be received at the office of Public Works, to the 12th of January, for $25,000 worth of incandescent lamps, to be delivered f. o. b. Tacoma, Wash., to the city of Tacoma, within one year and in such quantities as may be ordered from time to time by the Commissioner of Public Works.

VICTORIA, B. C.—The city will co-operate with the property owners on Douglas street for the lighting of that thoroughfare from Humboldt to Cormorant streets by means of the usual system of arc lamps. Mr. Challoner asked that the City Council should join with the owners in endeavoring to get the B. C. Electric Company to do everything possible to assist in the work of improvement.

SAN BERNARDINO, CAL.—The Corona gas plant has been swallowed up by the gas combine headed by J. M. Gardener of Pasadena. This announcement was made by the general superintendent of the San Bernardino Valley Gas Co., which now dominates the gas situation in this county and Riverside, having taken over the gas plants here, at Redlands, Riverside and Colton. It is proposed to install a general distributing plant either here or at Colton, and under heavy pressure distribute gas throughout the wide territory involved.

CHICO, CAL.—When the City Trustees met last week to open bids for city lighting there was but one bid presented, that of the Pacific Gas & Electric Company, but there were representatives of two other concerns, and as a result the opening of bids was postponed for a week. F. P. Bergen, superintendent of the Sacramento Valley Power Company, appeared and asked the trustees to delay the opening of bids indefinitely in order to permit of his company submitting a bid. He stated that the company expected to be serving Chico by the middle of February or March 1.

TRANSORTATION.

PUYALLUP, WASH.—The Puget Sound Electric Railway has begun laying concrete between its tracks on Stewart street.

FRESNO, CAL.—The Fresno Traction Company is planning to begin the work of the reconstruction of its unfinished lines and also the double-tracking at Fresno.

VISALIA, CAL.—The Southern Pacific has agreed to build an electric road between Visalia and Tulare if the people along the way will grant the necessary right of way.

BRAWLEY, CAL.—W. F. Holt has completed arrangements to build the Holton Interurban westward from El Centro to New River, where a new town is to be started.

POMONA, CAL.—A grading crew of the Pacific Electric Company is working through Claremont and a second trolley wire on Garey avenue, from Holt avenue north is being placed.

SAN BERNARDINO, CAL.—Bids will be received by the Board of Supervisors up to January 24, 1910 for a franchise for an electric railway, according to the application of W. W. Poole.

SAN FRANCISCO, CAL.—It has been decided to move the general offices of the United Railroads of this city from their present location in the Balboa Building to the Wells-Fargo Building.

CLE ELUM, WASH.—The City Council has refused to grant a franchise to the Cle Elum-Roslyn electric line because the promoters of the company refused to inform the Council of their intentions.

MONTESANO, WASH.—A. D. Devonshire is asking an injunction against the Eldridge Wheeler franchise for an interurban road through this county granted by the commissioners some time ago.

ASTORIA, ORE.—It is learned on the authority of an official of the company that the Lytle road, which is now being built from Hillsboro to the ocean at Tillamook Bay, is to be operated by electricity as soon as it is completed.

CHIHUAHUA, MEX.—The Chapala Hydroelectric and Irrigation Company has purchased the electric street railways of Aguascalientes and will operate them. The purchaser is the company which proposes transmitting hydroelectric power from Chapala to Aguascalientes.

WALLA WALLA, WASH.—E. M. Symonds of this place announces that new surveys are being made and portions of the right of way secured for the proposed Spokane, Walla Walla & Western Tranction Company's electric road and that work will begin on the road within a short time.

NEW WESTMINSTER, B. C.—Provision for the expenditure of a half million dollars was made at a recent meeting of the heads of the British Columbia Electric Railway and other companies. A large part of the money will be expended in building car shops and the remainder in rolling stock.

WALLACE, IDAHO.—R. A. Wilson of this place said in an interview that the residents of this city and the Coeur d'Alenes in general will renew their campaign for the extension of the Spokane & Inland Empire Electric Railway system from Coeur d'Alene City to Wallace to give them direct connection with Spokane..

LOS ANGELES, CAL.—A franchise for an extension of the West Ninth street electric line from Ninth to Park View street to Harvard, has been sold by the Council for $100 to Fred Forrester, representing property owners who have raised a bonus of $12,000 to induce the Los Angeles Railway Company to build an extension.

LOS ANGELES, CAL.—At a meeting of the Boyle Evergreen Improvement Association the committee in charge of the movement to secure extension of the Brooklyn avenue electric line from Evergreen avenue east to the city limits reported that of the $30,000 which it was expected to collect from property owners only $14,000 has been collected, leaving a balance of $16,000 which must be raised.

OAKLAND, CAL.—Announcement is made simultaneously with the advent of a corps of engineers who commenced surveying Leise avenue, the main street in Allendale, yesterday afternoon, by officials of the Oakland Traction Company, that it will extend the Leise avenue car line from Penniman street, the present terminus, in a northeasterly direction to within one block of the new Laurel school, a distance of nearly one mile.

OAKLAND, CAL.—The Oakland and Antioch Electric Railway is at last assured, and work was begun on the grading of the new road yesterday. The section of the road first to be built will extend from Oakland to Walnut Creek and Bay Point, with a branch to Martinez. The second section, which will be built immediately afterward, will extend to Antioch. It is the intention of the promoters to extend the road eventually to Stockton, where it will connect with other lines throughout the interior of the State. A. W. Maithy and S. L. Naphthaly, property owners of the Concord and Walnut Creek district, and heavily interested in the Central California road, between Stockton, Lodi and Sacramento, are the promoters of the project.

SAN JOSE, CAL.—By February 1st it is probable electric cars will be in operation between San Jose and Palo Alto by way of Meridian Corners, Monte Vista, Los Altos and Mayfield. Last week an order from the Southern Pacific offices went into effect on the "cut-off" line from Mayfield to Los Gatos, whereby the steam trains will hereafter use only the east track of the double-track line between Mayfield and Congress Junction, the west track being turned over to the Peninsula Railway Company, which is now "bonding" the rails with electric wires, erecting poles and stringing trolley lines over the track mentioned, from Mayfield as far as Monte Vista, where the tracks of the "cut-off" intersect those of the Cupertino trolley line to San Jose. It is expected that the work will be completed before February 1st, and that by that date, electric trolley cars will be in operation over the system from Palo Alto through Mayfield, Los Altos, Monte Vista, Meridian Corners, and into San Jose.

SAN FRANCISCO, CAL.—Attorney H. D. Pillsbury filed a petition in the U. S. Circuit Court last week asking for permission to intervene in the receivership proceedings instituted by the Baldwin Locomotive Works against the Ocean Shore Railway Company, and an order was signed by Circuit Judge Morrow granting the intervention. Pillsbury states that to build a single track road of 52 miles and equip it with steam has cost approximately $7,000,000. To complete the gap with 26 miles of double track, to double track that already built, to equip with electricity, to secure terminal facilities and to pay up indebtedness of $1,800,000 are the labors confronting the receiver, and it is urged by Pillsbury that they cannot be accomplished with an issue of $3,500,000 of receiver's certificates. He asks that competent engineers, who have never had connection with the road, be appointed before receiver's certificates are issued, and that they make a report on the estimated cost of completing the road. If the certificates are authorized he asks that their use be limited by the court, and that all other means be used to preserve their integrity.

WATERWORKS.

HELENA, CAL.—The Sacramento Valley Sugar Company contemplates the installation of a 1000 h. p. electric pumping plant for irrigation purposes at Helena, Cal.

SAN LUIS OBISPO, CAL.—The franchise to lay and maintain water pipes along the county roads and through the town of Avila has been awarded to G. O. Marre.

BAKER CITY, ORE.—An election to decide whether the upper or lower pipe line shall be used will be held January 20th. Bonds will be issued to cover the cost of the project.

CHICO, CAL.—The laying of pipe for Paradise's new water system will begin soon. A shipment of 5000 feet of pipe from San Francisco is expected in a few days. A tower is to be erected and a pump established.

PHOENIX, ARIZ.—The Board of Control of Ariz., at its office in the Capitol Building here, will receive sealed bids up to January 20th for furnishing one 50,000 gallon steel tank on a 40-foot steel tower, erected complete and ready for use at the Territorial prison at Florence.

LOS ANGELES, CAL.—Sealed bids will be received at the office of Treasurer Pacific Branch N. H. D. V. S. Soldiers Home, until January 14th for furnishing and laying sheet steel pipe branches in Mandeville canyon, in accordance with instructions with E. W. Moore.

SALEM, ORE.—Engineer W. J. Culver was employed by the city to make a survey to the Breitenbush for a water supply and estimate the cost as follows: Cost of right of way, laying pipes and bringing water to Salem, $605,088; cost of equipment and site for works, dam, etc., $183,682.

TACOMA, WASH.—The City Council has adopted a resolution for the laying of water mains on portions of McKinley avenue, South Fortieth street, Division Lane, Columbia avenue, East E street, East F street, East G street, South Thirty-eighth street, the same in local improvement district No. 549.

TOWNSEND, WASH.—Diver Finch has reported that the submarine pipe line which conducts water from the Olympic gravity system to Fort Flagler, where it crosses Scow Bay, is in bad shape and will require considerable time and expense to place in serviceable condition. The only way to remedy the evil is to relay the pipe around the extreme head of the bay.

SAN FRANCISCO, CAL.—City Attorney Long has advised the Board of Public Works that the bid of $139,000 submitted on behalf of Hansbrough Bros. Co. for the erection of the new Townsend street pumping station of the auxiliary water supply system must be rejected as invalid, though the lowest offer, because of being signed simply "S. L. Hansbrough, secretary," instead of the official name of the corporation. The City Attorney's opinion is of moment to the Public Works Board, as that body has already ordered all the bids, including that of Hansbrough Bros., to be rejected, but has been served with a citation secured from the Superior Court summoning the board to show cause on December 30 why the rejected bid shall not be accepted, the company insisting that it is valid.